

## TLP3544

### 1. Applications

- Mechanical relay replacements
- Security Systems
- Measuring Instruments
- Factory Automation (FA)
- Amusement Equipment

### 2. General

The TLP3544 photorelay consists of a photo MOSFET optically coupled to an infrared light emitting diode. It is housed in a 6-pin DIP package. The low ON-state resistance and the high permissible ON-state current of the the TLP3544 make it suitable for power line control applications.

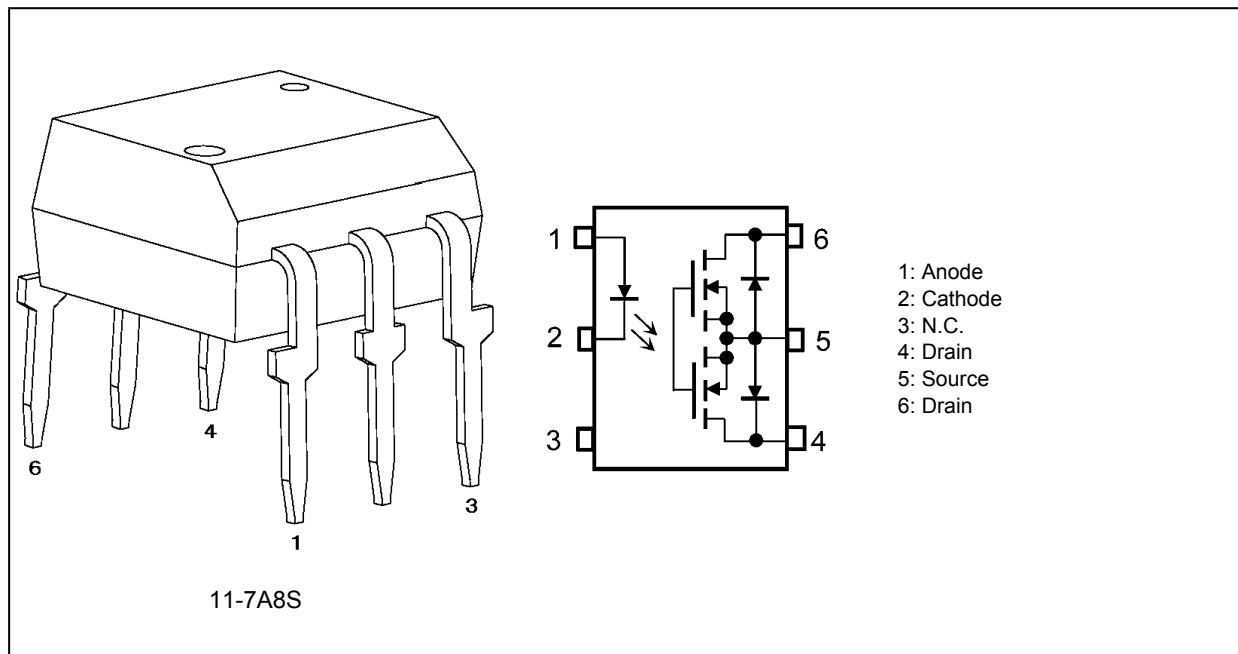
### 3. Features

- (1) Normally opened (1-Form-A)
- (2) OFF-state output terminal voltage: 40 V (min)
- (3) Trigger LED current: 3 mA (max)
- (4) ON-state current: 3.5 A (max) (A connection)
- (5) ON-state resistance: 60 mΩ (max) (A connection)
- (6) Isolation voltage: 2500 Vrms (min)
- (7) Safety standards

UL-approved: UL1577, File No.E67349

cUL-approved: CSA Component Acceptance Service No.5A File No.E67349

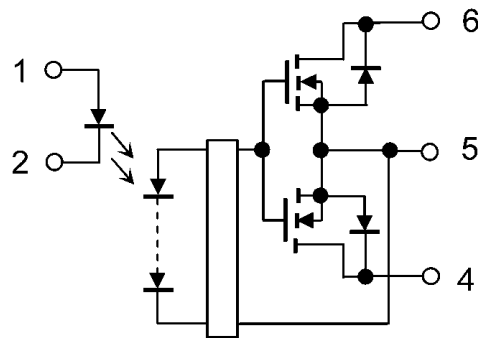
### 4. Packaging and Pin Configuration



Start of commercial production

2011-05

## 5. Internal Circuit



## 6. Absolute Maximum Ratings (Note) (Unless otherwise specified, $T_a = 25\text{ }^\circ\text{C}$ )

	Characteristics	Symbol	Note	Rating	Unit	
LED	Input forward current	$I_F$		30	mA	
	Input forward current derating ( $T_a \geq 25\text{ }^\circ\text{C}$ )	$\Delta I_F/\Delta T_a$		-0.3	mA/ $^\circ\text{C}$	
	Input reverse voltage	$V_R$		5	V	
	Input power dissipation	$P_D$		50	mW	
	Input power dissipation derating ( $T_a \geq 25\text{ }^\circ\text{C}$ )	$\Delta P_D/\Delta T_a$		-0.5	mW/ $^\circ\text{C}$	
	Junction temperature	$T_j$		125	$^\circ\text{C}$	
Detector	OFF-state output terminal voltage	$V_{OFF}$		40	V	
	ON-state current (A connection)	$I_{ON}$	(Note 1)	3.5	A	
	ON-state current (B connection)			3.5		
	ON-state current (C connection)			7		
	ON-state current derating (A connection) ( $T_a \geq 25\text{ }^\circ\text{C}$ )	$\Delta I_{ON}/\Delta T_a$	(Note 1)	-35	mA/ $^\circ\text{C}$	
	ON-state current derating (B connection) ( $T_a \geq 25\text{ }^\circ\text{C}$ )			-35		
	ON-state current derating (C connection) ( $T_a \geq 25\text{ }^\circ\text{C}$ )			-70		
	ON-state current (pulsed) ( $t = 100\text{ ms}$ , duty = 1/10)	$I_{ONP}$			10.5	A
	Output power dissipation	$P_O$			500	mW
	Output power dissipation derating ( $T_a \geq 25\text{ }^\circ\text{C}$ )	$\Delta P_O/\Delta T_a$			-5.0	mW/ $^\circ\text{C}$
	Junction temperature	$T_j$			125	$^\circ\text{C}$
	Common	Storage temperature	$T_{stg}$		-55 to 125	$^\circ\text{C}$
Operating temperature		$T_{opr}$		-40 to 85		
Lead soldering temperature (10 s)		$T_{sol}$		260		
Isolation voltage (AC, 60 s, R.H. $\leq 60\%$ )		$BV_S$	(Note 2)	2500	Vrms	

Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings.

Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Note 1: For an application circuit example, see Chapter 12.2.

Note 2: This device is considered as a two-terminal device: Pins 1, 2 and 3 are shorted together, and pins 4, 5 and 6 are shorted together.

## 7. Recommended Operating Conditions (Note)

Characteristics	Symbol	Note	Min	Typ.	Max	Unit
Supply voltage	$V_{DD}$		—	—	32	V
Input forward current	$I_F$		5	10	25	mA
ON-state current (A connection)	$I_{ON}$		—	—	3.5	A
Operating temperature	$T_{opr}$		-20	—	65	°C

Note: The recommended operating conditions are given as a design guide necessary to obtain the intended performance of the device. Each parameter is an independent value. When creating a system design using this device, the electrical characteristics specified in this data sheet should also be considered.

## 8. Electrical Characteristics (Unless otherwise specified, $T_a = 25\text{ °C}$ )

	Characteristics	Symbol	Note	Test Condition	Min	Typ.	Max	Unit
LED	Input forward voltage	$V_F$		$I_F = 10\text{ mA}$	1.18	1.33	1.48	V
	Input reverse current	$I_R$		$V_R = 5\text{ V}$	—	—	10	$\mu\text{A}$
	Input capacitance	$C_t$		$V = 0\text{ V}, f = 1\text{ MHz}$	—	70	—	pF
Detector	OFF-state current	$I_{OFF}$		$V_{OFF} = 40\text{ V}$	—	—	1	$\mu\text{A}$
	Output capacitance	$C_{OFF}$		$V = 0\text{ V}, f = 1\text{ MHz}$	—	1000	—	pF

## 9. Coupled Electrical Characteristics (Unless otherwise specified, $T_a = 25\text{ °C}$ )

Characteristics	Symbol	Note	Test Condition	Min	Typ.	Max	Unit
Trigger LED current	$I_{FT}$		$I_{ON} = 1.0\text{ A}$	—	0.5	3	mA
Return LED current	$I_{FC}$		$I_{OFF} = 10\text{ }\mu\text{A}$	0.1	—	—	mA
ON-state resistance (A connection)	$R_{ON}$	(Note 1)	$I_{ON} = 2.0\text{ A}, I_F = 5\text{ mA}, t < 1\text{ s}$	—	30	60	m $\Omega$
ON-state resistance (B connection)				—	15	—	
ON-state resistance (C connection)				—	8	—	

Note 1: For an application circuit example, see Fig. 12.2.

## 10. Isolation Characteristics (Unless otherwise specified, $T_a = 25\text{ °C}$ )

Characteristics	Symbol	Note	Test Condition	Min	Typ.	Max	Unit
Total capacitance (input to output)	$C_S$	(Note 1)	$V_S = 0\text{ V}, f = 1\text{ MHz}$	—	0.8	—	pF
Isolation resistance	$R_S$	(Note 1)	$V_S = 500\text{ V}, \text{R.H.} \leq 60\%$	$5 \times 10^{10}$	$10^{14}$	—	$\Omega$
Isolation voltage	$BV_S$	(Note 1)	AC, 60 s	2500	—	—	Vrms
			AC, 1 s in oil	—	5000	—	
			DC, 60 s in oil	—	5000	—	Vdc

Note 1: This device is considered as a two-terminal device: Pins 1, 2 and 3 are shorted together, and pins 4, 5 and 6 are shorted together.

## 11. Switching Characteristics (Unless otherwise specified, $T_a = 25\text{ }^\circ\text{C}$ )

Characteristics	Symbol	Note	Test Condition	Min	Typ.	Max	Unit
Turn-on time	$t_{ON}$		See Fig. 11.1. $R_L = 200\ \Omega$ , $V_{DD} = 20\ \text{V}$ , $I_F = 5\ \text{mA}$	—	2	5	ms
Turn-off time	$t_{OFF}$			—	0.1	1	
Turn-on time	$t_{ON}$		See Fig. 11.1. $R_L = 200\ \Omega$ , $V_{DD} = 20\ \text{V}$ , $I_F = 10\ \text{mA}$	—	1	3	
Turn-off time	$t_{OFF}$			—	0.1	1	

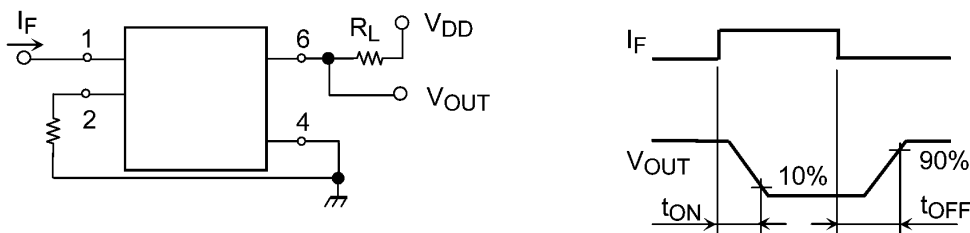


Fig. 11.1 Switching Time Test Circuit and Waveform

## 12. Characteristics Curves and Circuit Connections

### 12.1. Characteristics Curves (Note)

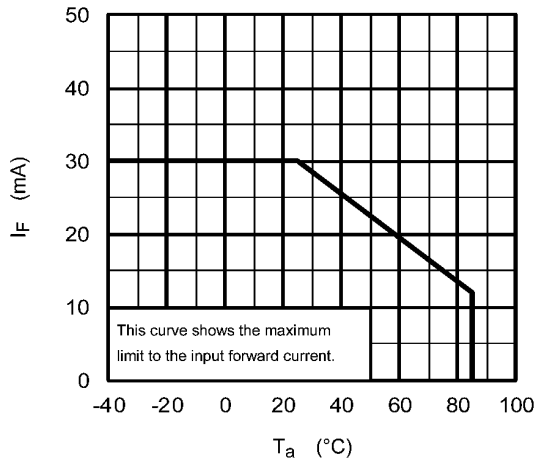


Fig. 12.1.1  $I_F - T_a$

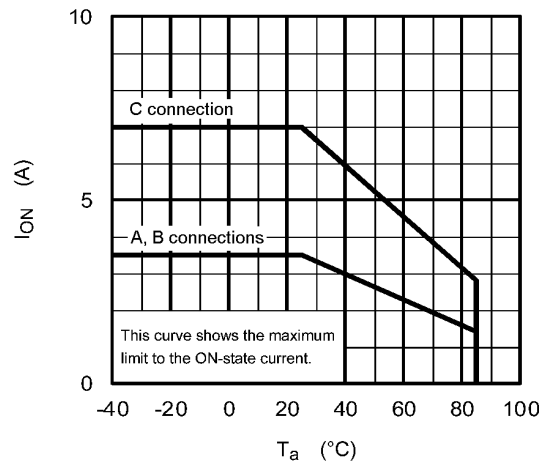


Fig. 12.1.2  $I_{ON} - T_a$

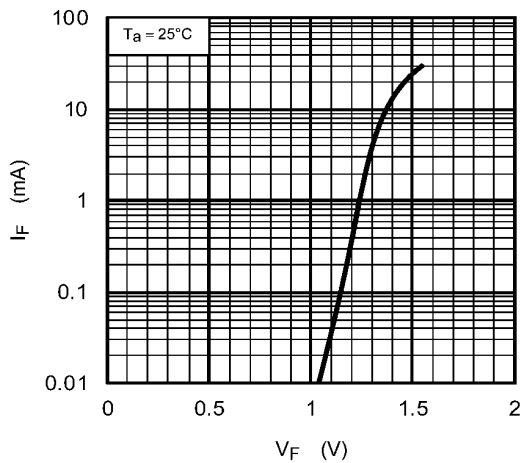


Fig. 12.1.3  $I_F - V_F$

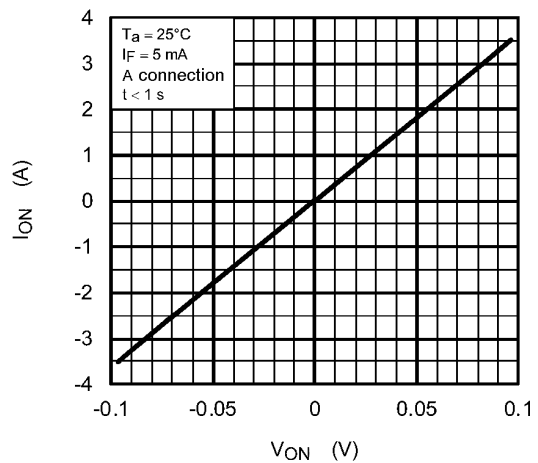


Fig. 12.1.4  $I_{ON} - V_{ON}$

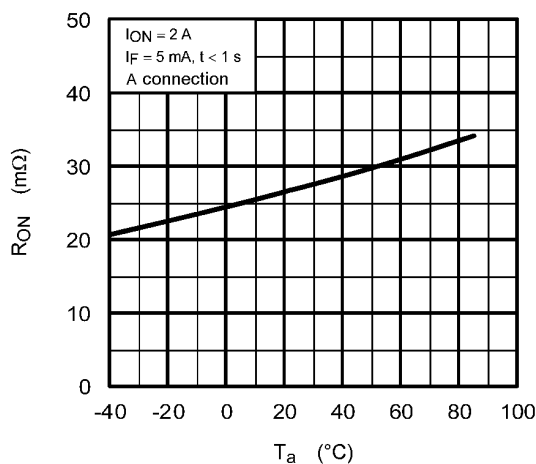


Fig. 12.1.5  $R_{ON} - T_a$

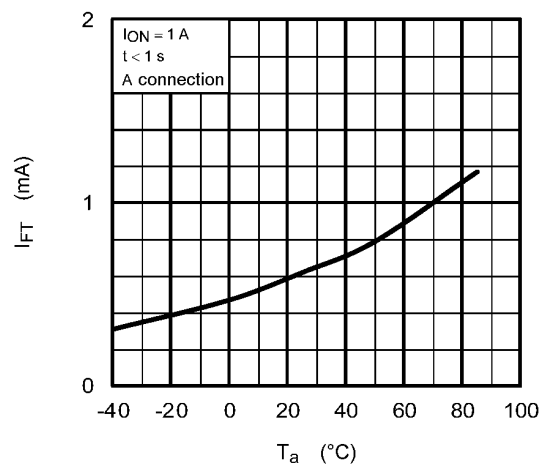


Fig. 12.1.6  $I_{FT} - T_a$

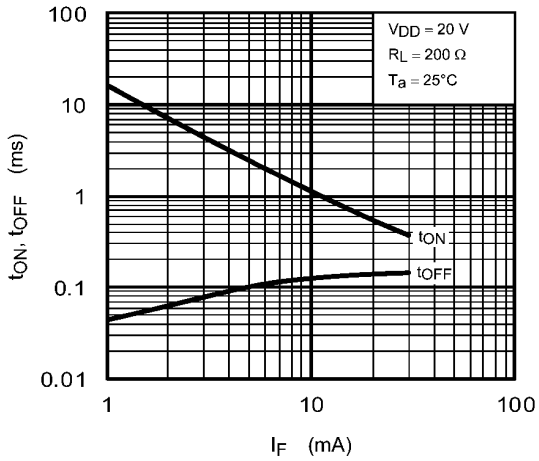


Fig. 12.1.7  $t_{ON}, t_{OFF} - I_F$

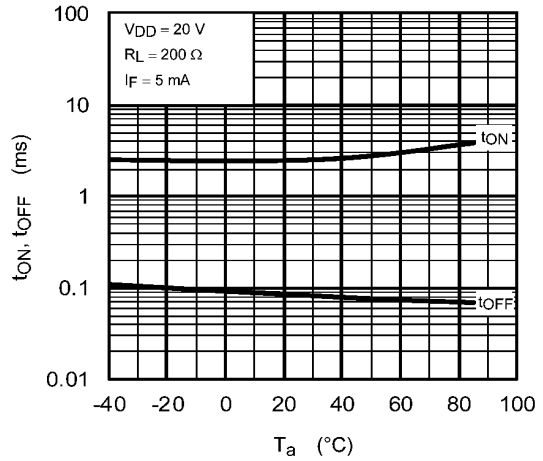


Fig. 12.1.8  $t_{ON}, t_{OFF} - T_a$

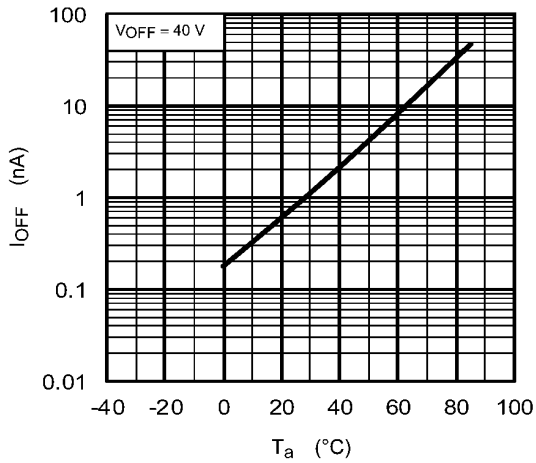
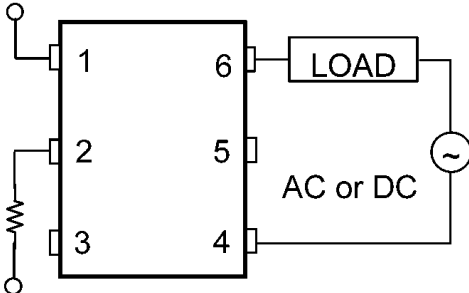


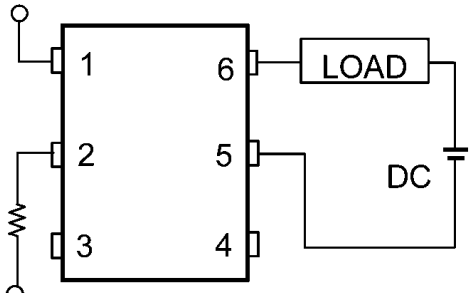
Fig. 12.1.9  $I_{OFF} - T_a$

Note: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

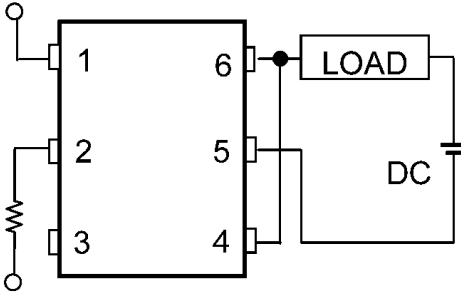
**12.2. Circuit Connections**



**Fig. 12.2.1 A Connection**



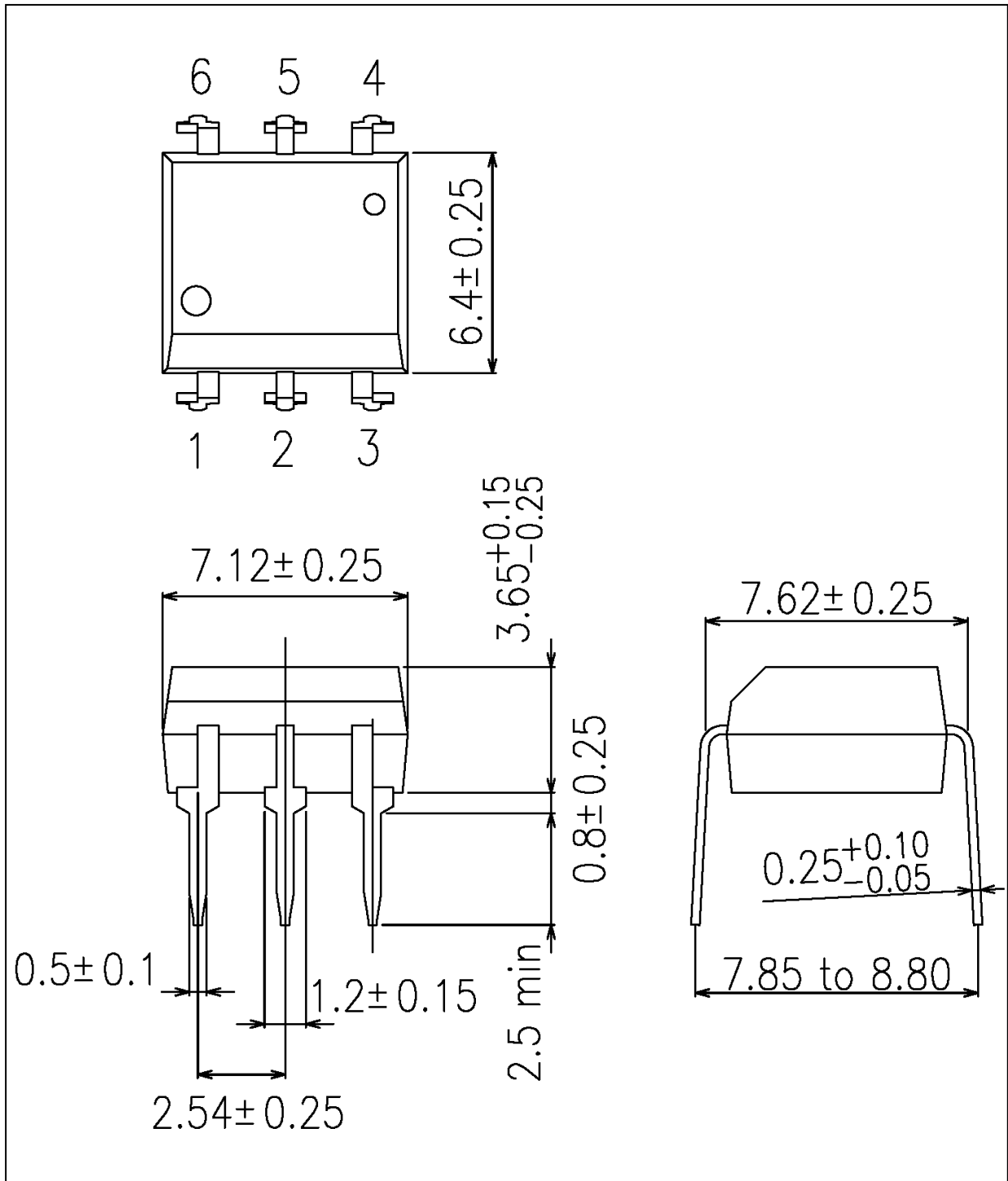
**Fig. 12.2.2 B Connection**



**Fig. 12.2.3 C Connection**

## Package Dimensions

Unit: mm



Weight: 0.4 g (typ.)

Package Name(s)
TOSHIBA: 11-7A8S



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